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RESEARCH ARTICLE

AM FUNGAL INTERACTION AND ITS BENEFICIAL EFFECTS ON *Crossandra infundibuliformis*

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ABSTRACT

Crossandra *infundibuliformis* is one of the perennial crop needs more amount of phosphorus for the initial root formation and development unfortunately most of the Indian soil lack phosphorus and there is a need for supplementing the phosphorus nutrition without causing soil pollution. Hence the organisms like AM fungi and phosphobacteria recommended increasing the availability of phosphorus to the plants. The present study of AM fungi and phophobacteria were inoculated along with graded levels of N, P and K fertilizers. The treatments of AM fungi and phophobacteria with 75 percent NPK + *G. fasciculatum* + phosphobacteria (T_{10}) and 50 percent recommended NPK + *G. fasciculatum* + phosphobacteria (T_{13}) recorded significant increase in growth values and yield when compared with control.

INTRODUCTION

India is one of the well known Asian countries in the world producing huge quantum of commercial flowers among which crossandra is one. The area under cultivation of crossandra extending day by day due to increase of demand in local and abroad markets. The estimated area in India is around 1700 hectares with the production of 430 tonnes. In Tamilnadu it has been cultivated around 980 hectares with the production of 250 tonnes per year. In India the farmers regularly using more amount of chemical fertilizers for crop production by this way Indian soils receiving pollutants and leads to cause pollution ultimately causes health hazards. In order to avoid environmental pollution i.e., soil pollution most of the scientist recommending the use of biofertilizers in the place of inorganic fertilizers. Biofertilizers are nothing but microbial inoculants, which are the preparations containing live or latent cells of efficient strains of microorganisms intended to improve the availability of nutrients like N, P and K and improves the soil fertility.

Crossandra infundibuliformis is one of the perennial crops which occupies in the same rhizosphere soil for more than years and remove most of the available nutrients from the rhizosphere soil and leads to pour content of nutrients particularly phosphorus. In order to overcome phosphorus deficiency the plants like *Crossandra* always requires the interaction of AM fungi if the plants having interaction of AM fungi in such type of soil never express deficiency symptoms to phosphorus because AM fungal mycelium acts something like feeder roots and scavenge required phosphorus from the surrounding soil. Most of the Indian soil contains more amount of phosphorus in unavailable form in order to improve the availability of phosphorus, most of microbiologist recommending phosphobacteria to almost all the crop plants. Based on the above traits the present research was undertaken to exploit the potentially of AM fungi and phosphobacteria in the growth and development of *Crossandra infundibuliformis.*

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MATERIALS AND METHODS

Crossandra infundibuliformis, Dindugal local which has proven to perform well in a comparative evaluation trail (Reddy, 2000) was selected and utilized for this experiment. The inoculants of AM fungi was isolated and screened based on the efficiency, one of the very best isolate was selected and used for the field experiments. Phosphobacteria was obtained from the Department of Agricultural Microbiology, Faculty of Agriculture, Annamalai University also used for the interaction studies. In organic fertilization was done following the recommended dosage of 15:10:25 g of N, P and K per plot of $2m^2$ in the form of urea, superphosphate and muriate of potash. The recommended dose of phosphobacteria (each at 2 kg per hectare) were inoculated through seedlings dip for half an hour, as per the treatment schedule and recommended AM fungal inoculums were placed in the root zone at the rate 20-50 spores/gplant^{-1}. Observations were recorded in five plants tagged at random leaving boarder in each replication

(fifteen plants in each treatment) at different stages. Height of the plant from ground level to the tip of the main stem was measured twice at initial and peak flowering period was expressed in centimeters. Number of days taken from the date of transplanting to first flowering was recorded and expressed in days. Total number of flowers that were produced in each spike was counted. Flowers picked at each harvest per plant were weighed separately and added over all the harvests to arrive at flower yield per plant and was expressed in grams. The following treatments were used in the present investigation. The experiment was laid out following principles of randomized block design. The plants were subjected to thirteen treatments each one was replicated thrice. Under each replication, 12 plants were maintained.

Treatment details

T_1 : Control
T_2 : 100% NPK alone
T_3 : *Glomus fasciculatum* alone
T_4 : Phosphobacteria alone
T_5 : 100% NPK + *Glomus fasciculatum*
T_6 : 100% NPK + phosphobacteria
T_7 : 100%NPK + *Glomus fasciculatum* + phosphobacteria
T_8 : 75% NPK + *Glomus fasciculatum*
T_9 : 75% NPK + phosphobacteria
T_{10} : 75% NPK + *Glomus fasciculatum* + phosphobacteria
T_{11} : 50% NPK + *Glomus fasciculatum*
T_{12} : 50% NPK + phosphobacteria
T_{13} : 50% NPK + *Glomus fasciculatum* + phosphobacteria

RESULTS AND DISCUSSION

The present research was conducted with an objective to find out the influence of biofertilizers viz., AM fungi and phosphobacteria in addition to inorganic fertilizers on plant growth, yield of flowers in *Crossandra infundibuliformis* is Dindugal local plant. The results of the mean performance of various parameters observed were statistically analysed (Table 1).

Gradual increase in plant height was observed in all treatment combinations at both the stages of observation. The highest plant height of 46.38 cm at initial flowering and 60.26 cm at peak flowering stage was recorded in (T_{10}) 75% NPK + *G. fasciculatum* + phosphobacteria. The next best value was observed in (T_{13}) 50% NPK + *G. fasciculatum* + phosphor bacteria 43.26 cm at initial flowering and 55.42 cm at peak flowering stage which exhibited statistically significant difference with (T_{10}). Among the treatments the least value of 18.56 cm at initial flowering and 26.84 cm at peak flowering was recorded in (T_1) control. The inoculation of AM fungi (*G. fasciculatum*) and phosphobacteria altered the flowering nature of crossandra. The earliness in flowering was noticed in (T_{10}) 75% NPK + *G. fasciculatum* + phosphobacteria (56.5 days). The next best value was observed in T_8 and T_9 (60 days) which did not exhibit statistically significant difference among themselves. The duration taken for first flowering was highest in (T_1) control (80 days) as shown in Table 1. A significant difference was noticed between control and other treatments receiving AM fungi and phosphobacteria. When compared with control, significant differences were recorded for flower yield among the treatments. The highest yield per plant and per hectare was recorded in (T_{10}) 75% NPK + *G. fasciculatum* + phosphobacteria respective 42.5 g/plant and 18.75 qha^{-1} as shown in Table 1. The lowest yield per plant was recorded in (T_1) control 20.4 g/plant and 13.85 qha^{-1}. Integrated use of organic fertilizers in flowers crops has not much explored and the research work based on integrated nutrient management in flower crops are scanty. Hence the present investigation was made with an aim to exploit the combined use of major nutrients and biofertilizers to minimize the cost of productivity in *C. infundibuliformis* cv. Dindigul local. The vegetative growth in *C. infundibuliformis* is measured interms of plant height, days of first flowering. Application of both AM fungi (*G. fasciculatum*) and phosphobacteria in combination the recommended dose of fertilizers had a significant effect in improving the plant height. The possible reason for the increase in plant height may be due to the inoculation of AM fungi and phosphobacteria which enhanced the uptake of nitrogen, since N is the chief constituent of protein, essential

Table 1. Inoculation effect of AM fungi and phosphobacteria on the growth and yield of *Crossandra infundibuliformis*

Treatments		Plant height		Days taken for 1st flowering	Flower yield	
		1st flowering	Peak flowering		Per plant (g)	qha^{-1}
T_1	Control	18.56	26.84	80.0	20.4	13.85
T_2	100% NPK alone	37.54	42.50	61.0	41.5	21.34
T_3	*G. fasciculatum* alone	30.28	39.20	68.5	36.8	16.95
T_4	Phosphobacteria alone	26.30	34.80	67.0	34.6	14.58
T_5	100% NPK + *G. fasciculatum*	42.64	52.90	61.0	41.8	21.68
T_6	100% NPK + Phosphobacteria	41.81	50.83	61.0	41.6	21.36
T_7	100% NPK + *G. fasciculatum* + Phosphobacteria	42.80	53.82	61.0	41.9	21.75
T_8	75% NPK + *G. fasciculatum*	40.10	48.92	60.0	40.8	20.84
T_9	75% NPK + Phosphobacteria	39.80	46.60	60.0	39.6	19.90
T_{10}	75% NPK + *G. fasciculatum* + Phosphobacteria	46.38	60.26	56.5	42.5	22.50
T_{11}	50% NPK + *G. fasciculatum*	38.80	44.84	61.0	38.7	18.75
T_{12}	50% NPK + Phosphobacteria	37.56	42.66	61.00	37.3	17.80
T_{13}	50% NPK + *G. fasciculatum* + Phosphobacteria	43.26	55.42	59.5	42.3	22.48
	SE	1.38	1.69	1.39	0.09	0.004
	CD (p = 0.05)	2.98	3.48	2.90	0.18	0.01

for the formation of protoplasm which leads to cell enlargement resulting increased plant growth (Bakley, 1974). Application of AM fungi and phosphobacteria also increased the plant height through the solubilization and mobilization of phosphates. Increased availability of phosphorus in very early stage would have helped in early vigorous root growth. This would have helped in the absorption of all the major and micronutrients required for the plants to put forth early vigorous vegetative growth in the absence of phosphorus in root zone. AM fungi scavenge phosphorus from surrounding soil. Another mechanism by which phosphobacteria increase the plant growth by biosynthesis of growth promoting substance like auxin (Sattar and Guar, 1987) and IAA (Barea et al., 1976). Similar views were also expressed in Manonmani (1992) in jasmine. In the present investigation, early flowering was noticed in the treatment receiving recommended dose of fertilizer along with AM fungi and phosphobacteria. It may be due to better nutritional status of the plants, as influenced by the various treatments. Due to more photosynthetic effect, flowering was induced thus effecting early initiation of flower bud formation. This finding is line with Karunakaran (1997) in *Crossandra infundibuliformis*. The enhanced flower yield in terms of weight was observed to be maximum in the plants treated with recommended dose of fertilizer along with AM fungi and phosphobacteria. The observation also revealed that the treatment receiving 75% recommended dose along with AM fungi was comparable with treatment receiving 100% recommended dose alone. This result seems to concede the reports of Bhavani Shankar and Vanangamudi (2000) in crossandra, Preethi (1990) in Edward rose, Wange *et al.* (1995) in tuberose.

Conclusion

Based on the above findings, it is clear that, the use of AM fungi and phosphobacteria can able to promote growth and yield of *Crossandra infundibuliformis* with the minimized use of chemical fertilizers and leads to reduction of 50 percent cost of chemical fertilizers incurred in *C. infundibuliformis* cultivation as well as reduction of pollution to some extent.

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